What is claimed is:

1. A process for fabricating an integrated optic device, comprising:

   a. preparing a photosensitive sol-gel glass material that includes a highly volatile photosensitizer;

   b. producing a film of said photosensitive sol-gel on at least a portion of a substrate;

   c. imprinting said photosensitive sol-gel film with an image of an optical device by exposing at least a portion of said photosensitive sol-gel film to light energy patterned in the positive or negative image of said device to photolyze photosensitizer within the exposed portion; and

   d. fixing the image of said optical device in said exposed sol-gel film to thereby form a planar device layer having an embedded optical device.

2. The process according to claim 1, wherein preparing said photosensitive sol-gel glass material comprises the steps of a.) forming a sol-gel by mixing a metal alkoxide, water, and a polysilane plasticizer, b.) adding said highly volatile photosensitizer to the sol-gel, said photosensitizer including a photo labile moiety and an inorganic glass modifying constituent, and c) mixing said photosensitizer with said sol-gel.

3. The process of claim 1, wherein said photosensitizer is an organometallic photosensitizer having the form R-M-X, wherein R is a branched, unbranched or cyclo-alkyl group each of less than 20 carbons, M is a metal or semi-metal, and X is a photo labile moiety selected from the group of halogens and carbonyls (CO).

4. The process of claim 3, wherein M is a metal selected from the Group IVA, VA, VIA, VIIA, VIIIA, IIB, IIIB, IVB, and VIB metals and rare earth metals or a semi-metal selected from the semi-metals within the Group IIIB, IVB, VB, and VIB elements.

97. The process according to claim 96, further comprising forming said cladding and buffer layers from a sol-gel glass material including a polysilane plasticizer selected from the group consisting of organotrialkoxysilanes, organotriaminosilanes, and organotrihalosilanes, and forming said cladding and buffer layers from a single coating of said sol-gel glass material.

98. The process of claim 94, wherein said photosensitizer is an organometallic photosensitizer having the form R-M-X, wherein R is a branched, unbranched or cyclo-alkyl group each of less than 20 carbons, M is a metal or semi-metal, and X is a photo labile moiety selected from the group of halogens and carbonyls (CO).

99. The process according to claim 98, wherein said preparing step further comprises adding a polysilane plasticizer selected from the group consisting of organotrialkoxysilanes, organotriaminosilanes, and organotrihalosilanes to said photosensitive sol-gel glass material, and wherein said device layer is formed from a single photosensitive sol-gel film.

100. The process according to claim 98, wherein said fixing step includes heating said exposed sol-gel film to a temperature of approximately 80 °C to approximately 150 °C for a time sufficient to evaporate unphotolyzed photosensitizer from the exposed sol-gel film.

101. An integrated optic device comprising:

a. a substrate;

b. a planar photosensitive sol-gel derived glass optical device layer disposed on said substrate, said optical device layer including an embedded optical device, wherein the process of forming said device layer comprises i.) preparing a photosensitive sol-gel glass material that includes a highly volatile photosensitizer, ii.) producing a film of said photosensitive sol-gel on at least a

portion of said substrate, iii.) imprinting said photosensitive sol-gel film with an image of said optical device by exposing at least a portion of said photosensitive sol-gel film to light energy patterned in the positive or negative image of said device to photolyze photosensitizer within the exposed portion, and iv.) fixing the image of said optical device in said exposed sol-gel film.

2 ~~102~~. The integrated optic device according to claim 1 ~~101~~, wherein said optical device includes regions having different indices of refraction.

3 ~~103~~. The integrated optic device according to claim 1 ~~101~~, wherein said optical device layer includes at least three regions having different indices of refraction, at least two of which are photoinduced.

4 ~~104~~. The integrated optic device according to claim 1 ~~101~~ further comprising a buffer layer interposed between said substrate and said device layer.

5 ~~105~~. The integrated optic device according to claim 4 ~~104~~, wherein said buffer layer comprises a second sol-gel derived glass material.

~~4~~ 6 ~~106~~. The integrated optics device according to claim 5 ~~105~~, wherein said buffer layer is at least 2 μm thick and is less than or equal to 20 μm thick.

7 ~~107~~. The integrated optics device according to claim 6 ~~106~~, wherein said buffer layer is formed from a single film of said second sol-gel glass material.

8 ~~108~~. The integrated optic device according to claim 1 ~~101~~ further comprising a cladding layer disposed on said device layer.

9 ~~109~~. The integrated optic device according to claim 8 ~~108~~, wherein said cladding layer comprises a third sol-gel derived glass material.

10 ~~110~~. The integrated optics device according to claim 9 ~~109~~, wherein said cladding layer is at least 2 μm thick and is less than or equal to 20 μm thick.

11 ~~111~~. The integrated optics device according to claim 10 ~~110~~, wherein said cladding layer is formed from a single film of said third sol-gel glass material.

12 ~~112~~. The integrated optic device according to claim 8 ~~108~~ further comprising a protective layer disposed on said cladding layer, said protective layer forming a moisture barrier layer.

13 ~~113~~. The integrated optic device according to claim 12 ~~112~~, wherein said protective layer is from 5 μm thick to 100 μm thick.

14 ~~114~~. The integrated optic device according to claim 13 ~~113~~, wherein said protective layer comprises a polymer coating.

15 ~~115~~. The integrated optic device according to claim 14 ~~114~~, wherein said polymer coating comprises a polymer selected from the group consisting of poly-methyl-methacrylate (PMMA), poly-vinyl-acrylate (PVA), poly-vinyl-chloride (PVC) and poly-tetra-flouro-ethylene.

16 ~~116~~. The process according to claim 14 ~~114~~, wherein said protective layer is transparent.

17 ~~117~~. The integrated optic device according to claim 12 ~~112~~, wherein said protective layer comprises a metal coating.

18 ~~118~~. The integrated optic device according to claim 1 ~~101~~, wherein said photosensitizer is an organometallic photosensitizer having the form R-M-X, where R is a branched, unbranched or cyclo-alkyl group each of less than 20 carbons, M is a metal or semi-metal, and X is a photo labile moiety selected from the group of halogens and carbonyls (CO).

19 ~~119~~. The integrated optic device according to claim 18 ~~118~~, wherein the photosensitive sol-gel derived glass matrix in the exposed portion of said device layer is modified by a photoproduced oxide of a metal or semi-metal, wherein the metal is selected from the Group IVA, VA, VIA, VIIA, VIIIA, IIB, IIIB, IVB, and VIB metals and rare earth metals and the semi-metal is selected from the semi-metals within the Group IIIB, IVB, VB, and VIB elements.

20 ~~120~~. The integrated optic device according to claim 19 ~~119~~, wherein the photoproduced oxide is an oxide of a metal or semi-metal selected from the group consisting of Ge, Sn, Pb, Se, Te, Fe, Co, Ni, Ti, Zn, Nd, Er, Eu, Pr, Th, B, Si, and P.

21 ~~121~~. The integrated optic device according to claim 1 ~~101~~ or 8 ~~118~~, wherein said photosensitizer has a vapor pressure greater than or equal to approximately 20 mm Hg at 25°C.

22 ~~122~~. The integrated optic device according to claim 1 ~~101~~, wherein said device layer is at least 2 μm thick and is less than or equal to 20 μm thick.

23 ~~123~~. The integrated optic device according to claim 22 ~~122~~, wherein said device layer is formed from a single film of said photosensitive sol-gel glass material.

24 ~~124~~. The integrated optic device according to claim 23 ~~123~~, wherein said device layer is at least 4 μm thick.

25 ~~125~~. The integrated optic device according to claim 23 ~~123~~, wherein said device layer is at least 6 μm thick.

~~24~~ 26 ~~126~~. The integrated optic device according to claim 1 ~~101~~ or 23 ~~123~~, wherein said preparing step further comprises adding a polysilane plasticizer to said photosensitive sol-gel glass material and said photosensitive sol-gel derived glass matrix includes a plurality of Si atoms having an R group bonded thereto, wherein R= H, Me, Et, Pr, i-Pr, n-Bu, i-Bu, t-Bu, hexyl, octyl, decyl, dodecyl, vinyl, phenyl, benzyl, chloromethyl, and chloromethylphenyl.

27 ~~127~~. The integrated optic device according to claim 1 ~~101~~, wherein said embedded optical device comprises a waveguide.

28 ~~128~~. The integrated optic device according to claim 1 ~~101~~, wherein said embedded optical device comprises at least one optical device selected from the group consisting of a channel waveguide, a coupler, a splitter, a filter, a combiner, a fiber spacing concentrator, a beam expander, a beam concentrator, an optical add-drop, an arrayed waveguide, and a diffraction grating.

29 ~~129~~. The integrated optic device according to claim 19 ~~119~~, wherein the exposed portion of said device layer comprises at least two regions having different concentrations of the photoproduced oxide.

30 ~~130~~. The integrated optic device according to claim 1 ~~101~~, further comprising a photoinduced Δn value of at least 0.07% between the embedded optical device and a surrounding region of said device layer.

31
~~131~~. The integrated optic device according to claim ~~101~~ 1, further comprising a photoinduced Δn value of at least 0.14% between the embedded optical device and a surrounding region of said device layer.

32
~~132~~. The integrated optic device according to claim ~~101~~ 1, wherein said embedded optical device includes a photoinduced continuously graded refractive index region graded from a first index value to a second index value.

33
~~133~~. The integrated optic device according to claim ~~101~~ 1, wherein said embedded optical device includes a photoinduced quasi-continuously graded refractive index region graded from a first index value to a second index value.

34
~~134~~. The integrated optic device according to claim ~~101~~ 1, wherein said embedded optical device comprises a waveguide and said waveguide includes different photoinduced indices of refraction along its axis.

35
~~135~~. The integrated optic device according to claim ~~101~~ 1 further comprising a second buffer layer disposed on said device layer and a second planar photosensitive sol-gel derived glass optical device layer disposed on said second buffer layer, said second device layer including a second optical device embedded therein.

~~34~~ 36
~~136~~. The integrated optic device according to claim ~~101~~ 1, wherein said substrate comprises a semiconductor substrate.

37
~~137~~. An integrated optic device comprising:

a. a substrate; and

b. a photosensitive sol-gel derived glass device layer disposed on said substrate, said device layer comprising an embedded optical device and a surrounding region with different indices of refraction, wherein the Δn between

said device and said surrounding region is at least .001, the Δn results from different concentrations of a photoproduced oxide being incorporated into the glass matrix of said device layer in the regions forming said device and said surrounding region, and wherein said device layer is formed from a photosensitive sol-gel film that is at least 2 μm thick.

38 ~~138~~. An integrated optic device according to claim 37 ~~137~~, wherein the Δn between said device and said surrounding region is greater than or equal to 0.002.

39 ~~139~~. An integrated optic device according to claim 37 ~~137~~, wherein said device layer includes a plurality of Si atoms having an R group bonded thereto, wherein R= H, Me, Et, Pr, i-Pr, n-Bu, i-Bu, t-Bu, hexyl, octyl, decyl, dodecyl, vinyl, phenyl, benzyl, chloromethyl, and chloromethylphenyl.

40 ~~140~~. An integrated optic device comprising:

a. a substrate; and

b. a photosensitive sol-gel derived glass device layer disposed on said substrate, said device layer comprising an embedded optical device and a surrounding region with different indices of refraction, said optical device including a photoinduced continuously graded refractive index region that is graded from a first index value to a second index value.

41 ~~141~~. An integrated optic device comprising:

a. a substrate; and

b. a photosensitive sol-gel derived glass device layer disposed on said substrate, said device layer comprising an embedded optical device and a surrounding region with different indices of refraction, said optical device including a photoinduced quasi-continuously graded refractive index region that is graded from a first index value to a second index value.

42
~~142~~. An integrated optic device comprising:

a. a substrate; and

b. a photosensitive sol-gel derived glass device layer disposed on said substrate, said device layer comprising an embedded optical device and a surrounding region with different indices of refraction, said optical device comprising a waveguide having different photoinduced indices of refraction along its axis.

43
~~143~~. An integrated optic device comprising:

a. a substrate;

b. a photosensitive sol-gel derived glass device layer disposed on said substrate, said device layer comprising a plurality of embedded waveguides, each waveguide having an index of refraction greater than the index of refraction of regions immediately adjacent to said waveguides, wherein the Δn value between each waveguide and its corresponding adjacent regions is different than that of the other waveguides in the plurality.

44
~~144~~. An integrated optic device comprising:

a. a substrate; and

b. a photosensitive sol-gel derived glass device layer disposed on said substrate, said device layer comprising an embedded tapered waveguide and a surrounding region, said tapered waveguide having a first end and a second end, the second end being wider than the first end, wherein said tapered waveguide includes a photoinduced refractive index gradient that is graded from a first index value at the first end to a second index value at the second end, and wherein the first index value is greater than the second index value.

5. The process of claim 4, wherein M is selected from the group consisting of Ge, Sn, Pb, Se, Te, Fe, Co, Ni, Ti, Zn, Nd, Er, Eu, Pr, Th, B, Si, and P.

6. The process of claim 3, wherein said X is selected from the group consisting of: fluorine, chlorine bromine, iodine and carbonyl (CO).

7. The process of claim 3, wherein the photosensitizer is selected from the group consisting of trimethyl-tin-iodide, cyclopentadienyl titanium dichloride and iron pentacarbonyl.

8. The process of claims 1 or 3, wherein said photosensitizer has a vapor pressure greater than or equal to approximately 20 mm Hg at 25°C.

9. The process of claims 1 or 3, wherein said photosensitizer has a vapor pressure greater than or equal to approximately 40 mm Hg at 25°C.

10. The process of claim 1, wherein said imprinting step comprises exposing said photosensitive sol-gel film to light energy passed through a photolithography mask.

11. The process of claim 10, wherein said photolithography mask comprises a binary mask, a gray scale mask, or a phase mask.

12. The process of claim 1, wherein said photosensitive sol-gel film is imprinted with said device image using a laser writing process.

13. The process of claim 1, further comprising using a light source having a wavelength in the range of 150 to 700 nm to produce the light energy.

14. The process of claim 13, wherein said light source is an arc lamp or a laser.

15. The process of claim 14, wherein said light source is selected from the group consisting of a mercury discharge lamp, a frequency multiplied YAG laser, a frequency multiplied Nd:YAG laser, an excimer laser, and an argon ion laser.

16. The process according to claim 15, wherein said light source is an excimer laser selected from the group consisting of a KrF excimer laser and a ArF excimer laser.

17. The process according to claim 1, wherein said device layer is at least 2 μm thick and is less than or equal to 20 μm thick.

18. The process according to claim 17, further comprising forming said device layer from a single photosensitive sol-gel film.

19. The process according to claim 18, wherein said photosensitive sol-gel film is at least 4 μm thick.

20. The process according to claim 18, wherein said photosensitive sol-gel film is at least 6 μm thick.

21. The process according to claim 1 or 18, wherein said preparing step further comprises adding a polysilane plasticizer to said photosensitive sol-gel glass material.

22. The process according to claim 21, wherein said polysilane plasticizer is selected from the group consisting of organotrialkoxysilanes, organotriaminosilanes, and organotrihalosilanes.

23. The process according to claim 17, further comprising forming said device layer from a plurality of photosensitive sol-gel films by repeating steps b, c, and d sequentially at least two times.

24. The process according to claim 23, wherein each of said photosensitive sol-gel films produced in accordance with step b is at least 2 μm thick.

25. The process according to claim 23, wherein each of said photosensitive sol-gel films produced in accordance with step b is at least 4 μm thick.

26. The process according to claim 1, further comprising forming a buffer layer on said substrate prior to producing said photosensitive sol-gel film, and wherein said photosensitive sol-gel film is further produced over said buffer layer.

27. The process according to claim 26, further comprising forming said buffer layer from a sol-gel glass material.

28. The process according to claim 26, wherein said buffer layer is at least 2 μm thick and is less than or equal to 20 μm thick.

29. The process according to claim 28, further comprising forming said buffer layer from a sol-gel glass material including a polysilane plasticizer selected from the group consisting of organotrialkoxysilanes, organotriaminosilanes, and organotrihalosilanes, and forming said buffer layer from a single coating of said sol-gel glass material.

30. The process according to claim 1, further comprising forming a cladding layer over said device layer.

31. The process according to claim 30, further comprising forming said cladding layer from a sol-gel glass material.

32. The process according to claim 30, wherein said cladding layer is at least 2 μm thick and is less than or equal to 20 μm thick.

33. The process according to claim 32, further comprising forming said cladding layer from a sol-gel glass material including a polysilane plasticizer selected from the group consisting of organotrialkoxysilanes, organotriaminosilanes, and organotrihalosilanes, and forming said cladding layer from a single coating of said sol-gel glass material.

34. The process according to claim 1, further comprising forming a protective layer over said device layer, said protective layer forming a moisture barrier layer.

35. The process according to claim 34, wherein said protective layer is from 5 μm thick to 100 μm thick.

36. The process according to claim 34, wherein said protective layer is formed by forming a polymer coating over said device layer.

37. The process according to claim 34, wherein said protective layer is formed by forming a metal coating over said device layer.

38. The process according to claim 34, further comprising forming a cladding layer over said devise layer prior to forming said protective layer.

39. The process according to claim 1, wherein said photosensitive sol-gel film is imprinted with a channel waveguide.

40. The process according to claim 1, wherein said photosensitive sol-gel film is imprinted with at least one optical device selected from the group consisting of a channel waveguide, a coupler, a splitter, a filter, a combiner, a fiber spacing concentrator, a beam expander, a beam concentrator, an optical add-drop, an arrayed waveguide, and a diffraction grating.

41. The process according to claim 1, wherein said fixing step comprises subjecting said exposed sol-gel film to at least one heat treatment within the temperature range of 80 °C to 1000 °C.

42. The process according to claim 41, wherein said fixing step includes heating said exposed sol-gel film to a temperature of approximately 80 °C to approximately 150 °C for a time sufficient to evaporate unphotolyzed photosensitizer from the exposed sol-gel film.

43. The process according to claim 42, wherein the unphotolyzed photosensitizer is evaporated in 60 minutes or less.

44. The process according to claim 1, further comprising drying said photosensitive sol-gel film at room temperature prior to said imprinting step.

45. The process according to claim 1, further comprising exposing at least two regions within the exposed portion of the photosensitive sol-gel film to different amounts of light energy, thereby photolyzing different amounts of photosensitizer within each of the regions.

46. The process according to claim 1, wherein said imprinting step comprises delivering sufficient light energy to the exposed portion to result in a photoinduced Δn

value of at least 0.07% between the embedded optical device and a surrounding region of said device layer.

47. The process according to claim 1, wherein said imprinting step comprises delivering sufficient light energy to the exposed portion to result in a photoinduced Δn value of at least 0.14% between the embedded optical device and a surrounding region of said device layer.

48. The process according to claim 1, wherein said imprinting step includes writing a continuously graded refractive index region within the exposed portion by continuously grading the amount of light energy delivered to said photosensitive film over said region from a first amount to a second amount.

49. The process according to claim 1, wherein said imprinting step includes writing a quasi-continuously graded refractive index region within the exposed portion by periodically grading the amount of light energy delivered to said photosensitive film over said region from a first amount to a second amount.

50. The process according to claim 1, wherein the substrate comprises a semiconductor substrate.

51. A process for fabricating an integrated optic device, comprising:

a. preparing a photosensitive sol-gel glass material that includes a highly volatile photosensitizer, said photosensitizer including a photo labile moiety and an inorganic glass modifying constituent;

b. producing a film of said photosensitive sol-gel on at least a portion of a substrate;

c. imprinting said photosensitive sol-gel film with an image of an optical device by exposing at least a portion of said photosensitive sol-gel film to

photolyzing light energy patterned in the positive or negative image of said device, thereby photolyzing photosensitizer within the exposed portion and irreversibly binding the photodissociated glass modifying constituents to the sol-gel glass material, wherein the exposed portion comprises at least one region and the amount of light energy delivered to each region within the exposed portion determines the amount of the photosensitizer that is photolyzed within that region; and

d. fixing the image of said optical device in the exposed sol-gel film and thereby forming a planar device layer having an embedded optical device by heating said exposed sol-gel film to evaporate unphotolyzed photosensitizer remaining in said exposed film and to polymerize said exposed sol-gel film to form a glass matrix, said glass matrix being modified in each region of the exposed portion by the inorganic glass modifying constituents photodissociated within that region.

52. The process of claim 51, wherein said photosensitizer is an organometallic photosensitizer having the form R-M-X, wherein R is a branched, unbranched or cyclo-alkyl group each of less than 20 carbons, M is a metal or semi-metal, and X is a photo labile moiety selected from the group of halogens and carbonyls (CO).

53. The process according to claim 51, wherein said device layer is at least 2 μm thick and is less than or equal to 20 μm thick.

54. The process according to claim 53, further comprising forming said device layer from a single photosensitive sol-gel film.

55. The process according to claim 54, wherein said photosensitive sol-gel film is at least 4 μm thick.

56. The process according to claim 54, wherein said photosensitive sol-gel film is at least 6 μm thick.

57. The process according to claim 51 or 54, wherein said preparing step further comprises adding a polysilane plasticizer selected from the group consisting of organotrialkoxysilanes, organotriaminosilanes, and organotrihalosilanes.to said photosensitive sol-gel glass material.

58. The process according to claim 51, wherein said photosensitive sol-gel film is imprinted with a waveguide.

59. The process according to claim 51, wherein said fixing step comprises subjecting said exposed sol-gel film to at least one heat treatment within the temperature range of 80 °C to 1000 °C.

60. The process according to claim 59, wherein said fixing step includes heating said exposed sol-gel film to a temperature of approximately 80 °C to approximately 150 °C for a time sufficient to evaporate unphotolyzed photosensitizer from the exposed sol-gel film.

61. The process according to claim 60, wherein the unphotolyzed photosensitizer is evaporated in 60 minutes or less.

62. The process according to claim 51, further comprising exposing at least two regions within the exposed portion of the photosensitive sol-gel film to different amounts of light energy, thereby photolyzing different amounts of photosensitizer within each of the regions.

63. The process according to claim 51, wherein said imprinting step includes writing a continuously graded refractive index region within the exposed portion by continuously grading the amount of light energy delivered to said photosensitive film over said region from a first amount to a second amount.

64. The process according to claim 51, wherein said imprinting step includes writing a quasi-continuously graded refractive index region within the exposed portion by periodically grading the amount of light energy delivered to said photosensitive film over said region from a first amount to a second amount.

65. A process for fabricating an integrated optic device, comprising:

a. preparing a photosensitive sol-gel glass material that includes a volatile photosensitizer;

b. producing a film of said photosensitive sol-gel on at least a portion of a substrate;

c. imprinting said photosensitive sol-gel film with an image of an optical device by exposing at least a portion of said photosensitive sol-gel film to photolyzing light energy patterned in the positive or negative image of said device to photolyze photosensitizer within the exposed portion, wherein the exposed portion comprises at least one region and the amount of light energy delivered to each region within the exposed portion determines the amount of the photosensitizer that is photolyzed within that region; and

d. fixing the image of said optical device in the exposed sol-gel film and thereby forming a planar device layer having an embedded optical device by heating said exposed sol-gel film under a vacuum to evaporate unphotolyzed photosensitizer remaining in said exposed film and to polymerize said exposed sol-gel film to form a glass matrix, said glass matrix being modified in each region of the exposed portion by the inorganic glass modifying constituents photodissociated within that region.

66. The process of claim 65, wherein said photosensitizer is an organometallic photosensitizer having the form R-M-X, wherein R is a branched, unbranched or cyclo-alkyl group each of less than 20 carbons, M is a metal or semi-metal, and X is a photo labile moiety selected from the group of halogens and carbonyls (CO).

67. The process of claim 66, wherein said photosensitizer has a vapor pressure less than 20 mm Hg at 25 °C and wherein the vacuum employed in the fixing step is at least 0.001 Torr.

68. The process according to claim 67, wherein said fixing step includes heating said exposed sol-gel film to a temperature of approximately 80 °C to approximately 150 °C for a time sufficient to evaporate unphotolyzed photosensitizer from the exposed sol-gel film.

69. The process according to claim 68, wherein the unphotolyzed photosensitizer is evaporated in 60 minutes or less.

70. The process according to claim 65, wherein said preparing step further comprises adding a polysilane plasticizer selected from the group consisting of organotrialkoxysilanes, organotriaminosilanes, and organotrihalosilanes to said photosensitive sol-gel glass material, and wherein said device layer is greater than 2 μm thick and is less than or equal to 20 μm thick and is formed from a single photosensitive sol-gel film.

71. The process according to claim 70, wherein said photosensitive sol-gel film is at least 4 μm thick.

72. The process according to claim 65, further comprising exposing at least two regions within the exposed portion of the photosensitive sol-gel film to different amounts of light energy, thereby photolyzing different amounts of photosensitizer within each of the regions.

73. The process according to claim 65, wherein said imprinting step includes writing a continuously graded refractive index region within the exposed portion by continuously grading the amount of light energy delivered to said photosensitive film over said region from a first amount to a second amount.

74. The process according to claim 65, wherein said imprinting step includes writing a quasi-continuously graded refractive index region within the exposed portion by periodically grading the amount of light energy delivered to said photosensitive film over said region from a first amount to a second amount.

75. A process for fabricating an integrated optic device, comprising:

a. preparing a photosensitive sol-gel glass material by mixing a metal alkoxide, a polysilane plasticizer, and a volatile photosensitizer including a photo labile moiety and an inorganic glass modifying constituent;

b. producing a film of said photosensitive sol-gel on at least a portion of a substrate;

c. imprinting said photosensitive sol-gel film with an image of an optical device by exposing at least a portion of said photosensitive sol-gel film to photolyzing light energy patterned in the positive or negative image of said device, thereby photolyzing photosensitizer within the exposed portion and irreversibly binding the photodissociated glass modifying constituents to the sol-gel glass material, wherein the exposed portion comprises at least one region and the amount of light energy delivered to each region within the exposed

portion determines the amount of the photosensitizer that is photolyzed within that region; and

d. fixing the image of said optical device in the exposed sol-gel film and thereby forming a planar device layer having an embedded optical device by heating said exposed sol-gel film to evaporate unphotolyzed photosensitizer remaining in said exposed film and to polymerize said exposed sol-gel film to form a glass matrix, said glass matrix being modified in each region of the exposed portion by the inorganic glass modifying constituents photodissociated within that region.

76. The process of claim 75, wherein said photosensitizer is an organometallic photosensitizer having the form R-M-X, wherein R is a branched, unbranched or cyclo-alkyl group each of less than 20 carbons, M is a metal or semi-metal, and X is a photo labile moiety selected from the group of halogens and carbonyls (CO).

77. The process of claim 76, wherein said photosensitizer has a vapor pressure less than 20 mm Hg at 25 °C and wherein the exposed sol-gel film is heated in a vacuum of at least 0.001 Torr during said fixing step.

78. The process of claims 75 or 76, wherein said photosensitizer has a vapor pressure greater than or equal to approximately 20 mm Hg at 25°C.

79. The process according to claim 78, wherein said fixing step includes heating said exposed sol-gel film to a temperature of approximately 80 °C to approximately 150 °C for a time sufficient to evaporate unphotolyzed photosensitizer from the exposed sol-gel film.

80. The process according to claim 79, wherein the unphotolyzed photosensitizer is evaporated in 60 minutes or less.

81. The process according to claim 75, wherein said polysilane plasticizer is selected from the group consisting of organotrialkoxysilanes, organotriaminosilanes, and organotrihalosilanes, and wherein said device layer is greater than 2 μm thick and is less than or equal to 20 μm thick and is formed from a single photosensitive sol-gel film.

82. The process according to claim 81, wherein said plasticizer is an organotrialkoxysilanes of the type R-Si-$(OR)_3$, where R= H, Me, Et, Pr, i-Pr, n-Bu, i-Bu, t-Bu, hexyl, octyl, decyl, dodecyl, vinyl, phenyl, benzyl, chloromethyl, and chloromethylphenyl and OR= methoxy or ethoxy.

83. The process according to claim 82, wherein said photosensitive sol-gel film is at least 4 μm thick.

84. The process according to claim 75, further comprising exposing at least two regions within the exposed portion of the photosensitive sol-gel film to different amounts of light energy, thereby photolyzing different amounts of photosensitizer within each of the regions.

85. The process according to claim 75, wherein said imprinting step includes writing a continuously graded refractive index region within the exposed portion by continuously grading the amount of light energy delivered to said photosensitive film over said region from a first amount to a second amount.

86. The process according to claim 75, wherein said imprinting step includes writing a quasi-continuously graded refractive index region within the exposed portion by periodically grading the amount of light energy delivered to said photosensitive film over said region from a first amount to a second amount.

87. A process for fabricating an integrated optic device, comprising:
    a. forming an optical device on a substrate;
    b. forming a cladding layer over the optical device;
    c. forming a protective layer over the cladding layer, said protective layer comprising a moisture barrier layer.

88. The process of claim 87, wherein said protective layer is from 5 μm thick to 100 μm thick.

89. The process according to claim 88, wherein said protective layer is formed by forming a polymer coating over said device layer.

90. The method of claim 89, wherein said polymer comprises a polymer selected from the group consisting of poly-methyl-methacrylate (PMMA), poly-vinyl-acrylate (PVA), poly-vinyl-chloride (PVC) and poly-tetra-flouro-ethylene.

91. The process according to claim 89, wherein said protective layer is transparent.

92. The process according to claim 87, wherein said protective layer is formed by forming a metal coating over said device layer.

93. The process according to claim 87, wherein the step of forming an optical device on said substrate includes the steps of preparing a photosensitive sol-gel glass material that includes a volatile photosensitizer, producing a film of said photosensitive sol-gel on at least a portion of a substrate, imprinting said photosensitive sol-gel film with an image of an optical device by exposing at least a portion of said photosensitive sol-gel film to light energy patterned in the positive or negative image of said device to photolyze photosensitizer within the exposed portion, and fixing the image of said

optical device in said exposed sol-gel film to thereby form a planar device layer having an embedded optical device.

94. A process for fabricating an integrated optic device, comprising:

a. forming a buffer layer on a substrate;

b. preparing a photosensitive sol-gel glass material that includes a volatile photosensitizer;

b. producing a film of said photosensitive sol-gel on said buffer layer;

c. imprinting said photosensitive sol-gel film with an image of an optical device by exposing at least a portion of said photosensitive sol-gel film to photolyzing light energy patterned in the positive or negative image of said device to photolyze photosensitizer within the exposed portion, wherein the exposed portion comprises at least one region and the amount of light energy delivered to each region within the exposed portion determines the amount of the photosensitizer that is photolyzed within that region; and

d. fixing the image of said optical device in the exposed sol-gel film and thereby forming a planar device layer having an embedded optical device by heating said exposed sol-gel film under a vacuum to evaporate unphotolyzed photosensitizer remaining in said exposed film and to polymerize said exposed sol-gel film to form a glass matrix, said glass matrix being modified in each region of the exposed portion by the inorganic glass modifying constituents photodissociated within that region; and

e. forming a cladding layer of said device layer;

95. The process of claim 94, further comprising forming a protective layer over said cladding layer, said protective layer forming a moisture barrier layer.

96. The process of claim 94, wherein said buffer layer, device layer, and cladding layer are each greater than 2 μm thick and less than or equal to 20 μm.